

(12) United States Patent Kim et al.

(10) Patent No.:

US 6,288,902 B1

(45) Date of Patent:

*Sep. 11, 2001

(54) MODULAR DATA STORAGE SYSTEM FOR REDUCING MECHANICAL SHOCK AND VIBRATIONS

(75) Inventors: Kwang Ho Kim, Santa Clara; Julie McDonald, San Jose, both of CA (US)

(73) Assignee: Hewlett-Packard Company, Palo Alto, CA (US)

(*) Notice:

This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/318,512

(22) Filed: May 25, 1999

(51) Int. Cl.⁷ H05K 7/14

(56) References Cited

U.S. PATENT DOCUMENTS

3,603,845 * 9/197	1 Beers	361/796
3,697,084 10/197	2 Ban	274/4 F
	6 Heidecker et al	
3,964,098 6/197	6 Kramer et al	360/93
4,062,049 12/197	7 Dirks	360/78
	O Grapes et al	360/97
	2 Cronin et al	

4,349,850	9/1982	Harvey	
4,359,762			

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

808848	2/1956	(DE) .
52-218815	2/1977	(JP) .
57-94687	12/1980	(JP) .

OTHER PUBLICATIONS

Signal, Oct. 1982, p. 102 (5800R).

Defense Electronics, Oct. 1982, p. 34 (Rolm Military Hard

Signal, Oct. 1982, p. 102 (Dataflux). Mini-Micro Systems, Jun. 1981.

Signal, Dec. 1981, (Mil-Spec From Ground Up).

Defense Electronics, Mar. 1981, p. 97 (Miltope Corporation).

Defense Electronics, Dec. 1982, p. 51 (Sunstrand Data Control, Inc.).

IBM Technical Disclosure Bulletin, vol. 24(1A), Jun. 1981. IBM Technical Disclosure Bulletin, vol. 19 (10), Mar. 1977. Compaq ProLiant Server 1998.

Dell PowerEdge Server 1998.

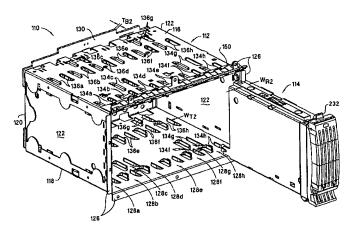
(List continued on next page.)

Primary Examiner—Jeffrey Gaffin Assistant Examiner—David Foster

(57) ABSTRACT

The present invention provides a modular data storage system that can constraint movement of a data storage module within an enclosure during operation, handling, and transportation. The present invention achieves the objective by employing compliant features at strategic locations in the data storage system by utilizing shock/vibration isolators and the frictional forces generated by the compliant elements to introduce damping effects. In addition, this invention provides a locking mechanism that will allow the user to smoothly insert, remove and firmly grip a data storage module.

16 Claims, 11 Drawing Sheets



US 6,288,902 B1 Page 2

U.S. PATENT DOCUMENTS	5,892,662 * 4/1999 Verma
4,413,328 11/1983 Videki, II	
4,633,250 12/1986 Hanson	
4,716,495 * 12/1987 Craker	
4,912,580 3/1990 Hanson	
5,006,961 * 4/1991 Monico	1000
5,122,914 6/1992 Hanson	
5,313,369 * 5/1994 Lewis et al	361/796 IBM Netfinity1 Server 1998.
5,327,308 7/1994 Hanson	
5,396,401 * 3/1995 Nemoz	
5,515,215 5/1996 Hanson	
5,517,373 5/1996 Hanson	
5,563,748 10/1996 Hanson	
5,602,696 2/1997 Hanson	360/97.01 Symbios 1998
5,642,264 * 6/1997 Cantrell	301/802 LID Diels Arroy 1005
5,652,697 * 7/1997 Le	DEC 0: 1 1004
5,682,277 10/1997 Hanson	
5,717,570 * 2/1998 Kikinis	
5,764,434 6/1998 Hanson	
5,883,757 3/1999 Hanson	360/97.01 * cited by examiner